National Aeronautics and Space Administration

NASA Exploration Plans

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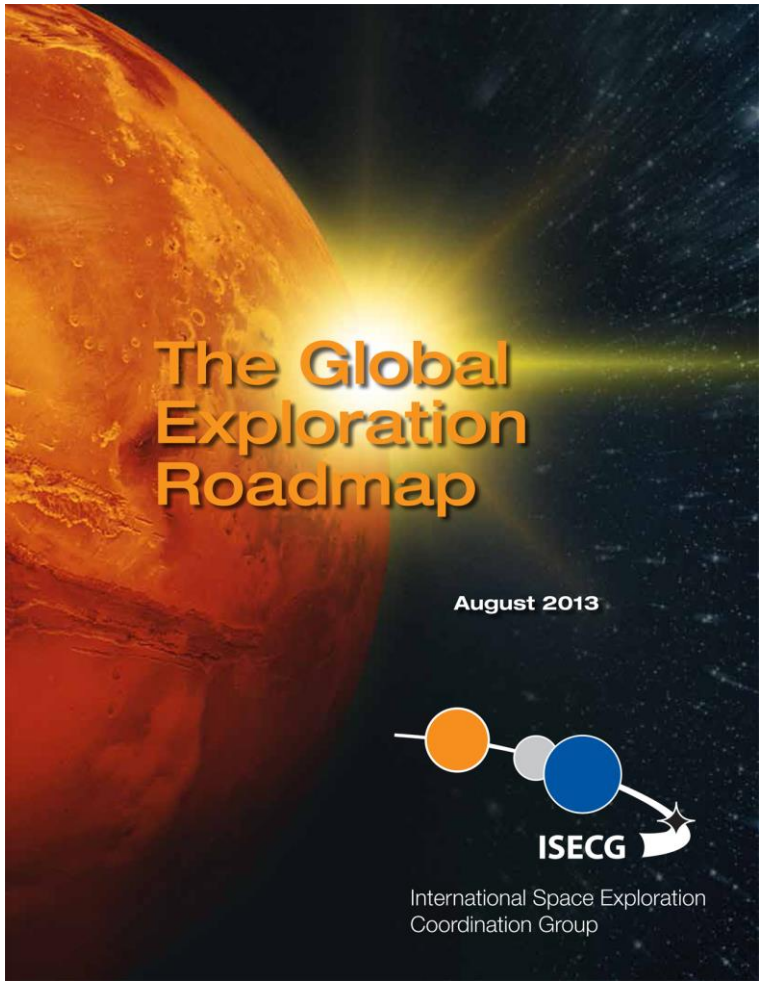
INTERNATIONAL SPACE EXPLORATION COORDINATION GROUP
GLOBAL EXPLORATION ROADMAP



Global Exploration Roadmap – Version Three scheduled for release January 2018

EXPANDING HUMAN PRESENCE IN PARTNERSHIP

CREATING ECONOMIC OPPORTUNITIES, ADVANCING TECHNOLOGIES, AND ENABLING DISCOVERY

Now

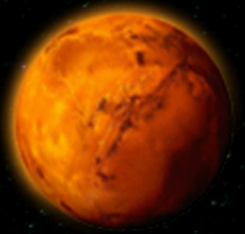
Using the International Space Station

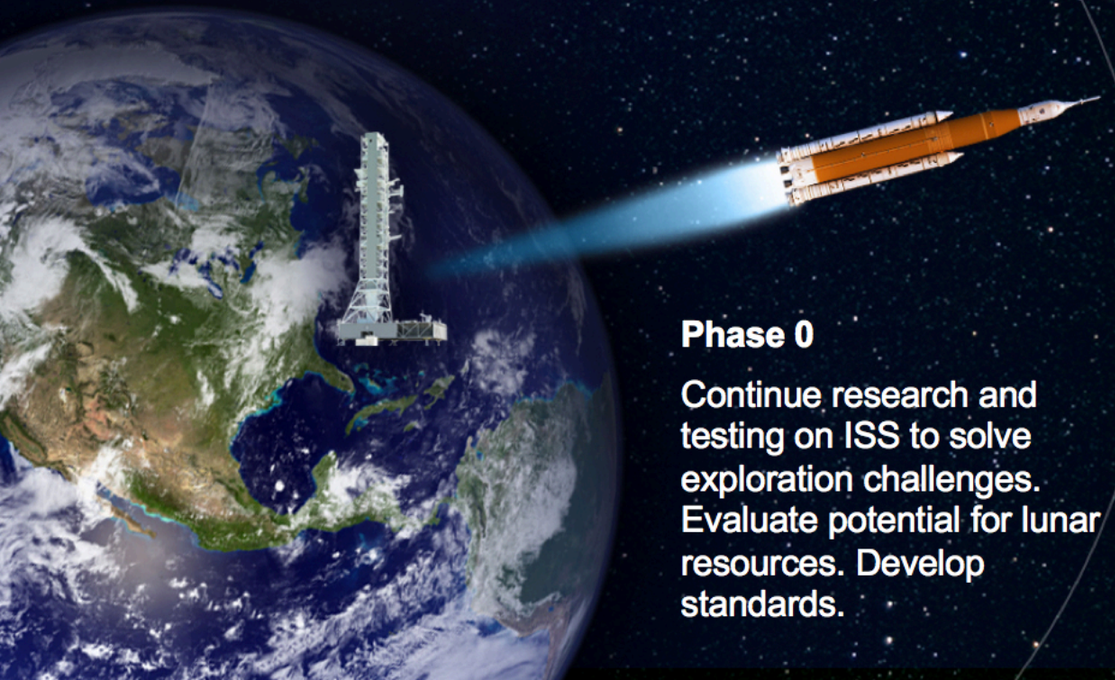
2020s

Operating in the Lunar Vicinity (proving ground)

After 2030

Leaving the Earth-Moon System and Reaching Mars Orbit





Phase 0

Continue research and testing on ISS to solve exploration challenges. Evaluate potential for lunar resources. Develop standards.

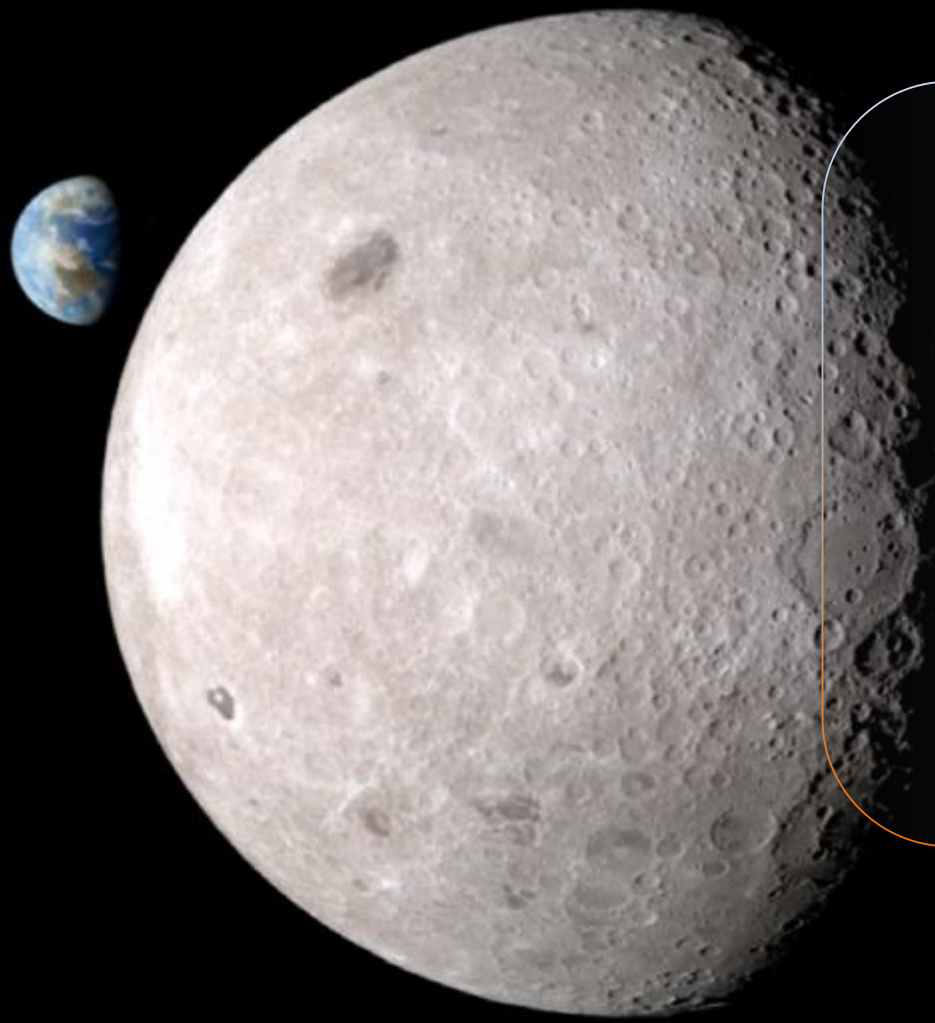
Phase 1

Begin missions in cislunar space. Initiate next key deep space capability.

Phase 2

Complete next deep space capability and checkout.

HOW ARE WE LEADING FUTURE EXPLORATION



- **Maximizing utilization of the International Space Station**
- **Actively promoting LEO commercialization**
- **Resolving the human health and performance challenges**
- **Expanding partnerships with commercial industry**
- **Growing international partnerships**
- **Building the critical *Deep Space Infrastructure***
- **Enabling the capabilities to explore multiple destinations**

STRATEGIC PRINCIPLES FOR SUSTAINABLE EXPLORATION

- **FISCAL REALISM**
  Implementable in the near-term with the buying power of current budgets and in the longer term with budgets commensurate with economic growth;

- **SCIENTIFIC EXPLORATION**
  Exploration enables science and science enables exploration; leveraging scientific expertise for human exploration of the solar system.

- **TECHNOLOGY PULL AND PUSH**
  Application of high Technology Readiness Level (TRL) technologies for near term missions, while focusing sustained investments on technologies and capabilities to address the challenges of future missions;

- **GRADUAL BUILD UP OF CAPABILITY**
  Near-term mission opportunities with a defined cadence of compelling and integrated human and robotic missions, providing for an incremental buildup of capabilities for more complex missions over time;

- **ECONOMIC OPPORTUNITY**
  Opportunities for U.S. commercial business to further enhance their experience and business base;

- **ARCHITECTURE OPENNESS AND RESILIENCE**
  Resilient architecture featuring multi-use, evolvable space infrastructure, minimizing unique developments, with each mission leaving something behind to support subsequent missions;

- **GLOBAL COLLABORATION AND LEADERSHIP**
  Substantial new international and commercial partnerships, leveraging current International Space Station partnerships and building new cooperative ventures for exploration; and

- **CONTINUITY OF HUMAN SPACEFLIGHT**
  Uninterrupted expansion of human presence into the solar system by establishing a regular cadence of crewed missions to cis-lunar space during ISS lifetime.

The International Space Station (ISS) is a platform for deep space exploration, scientific research, economic growth and global diplomacy. ISS brings the world together to discover, develop and advance solutions for a better life both here on Earth and in space.

INTERNATIONAL SPACE STATION PARTNERSHIPS

Created by a partnership of 5 space agencies representing 15 nations

The largest peace time effort amongst the most countries in recorded human history.

Creating knowledge that improves life here on earth and provides a stepping stone for humanity's destiny . . . to live among the stars

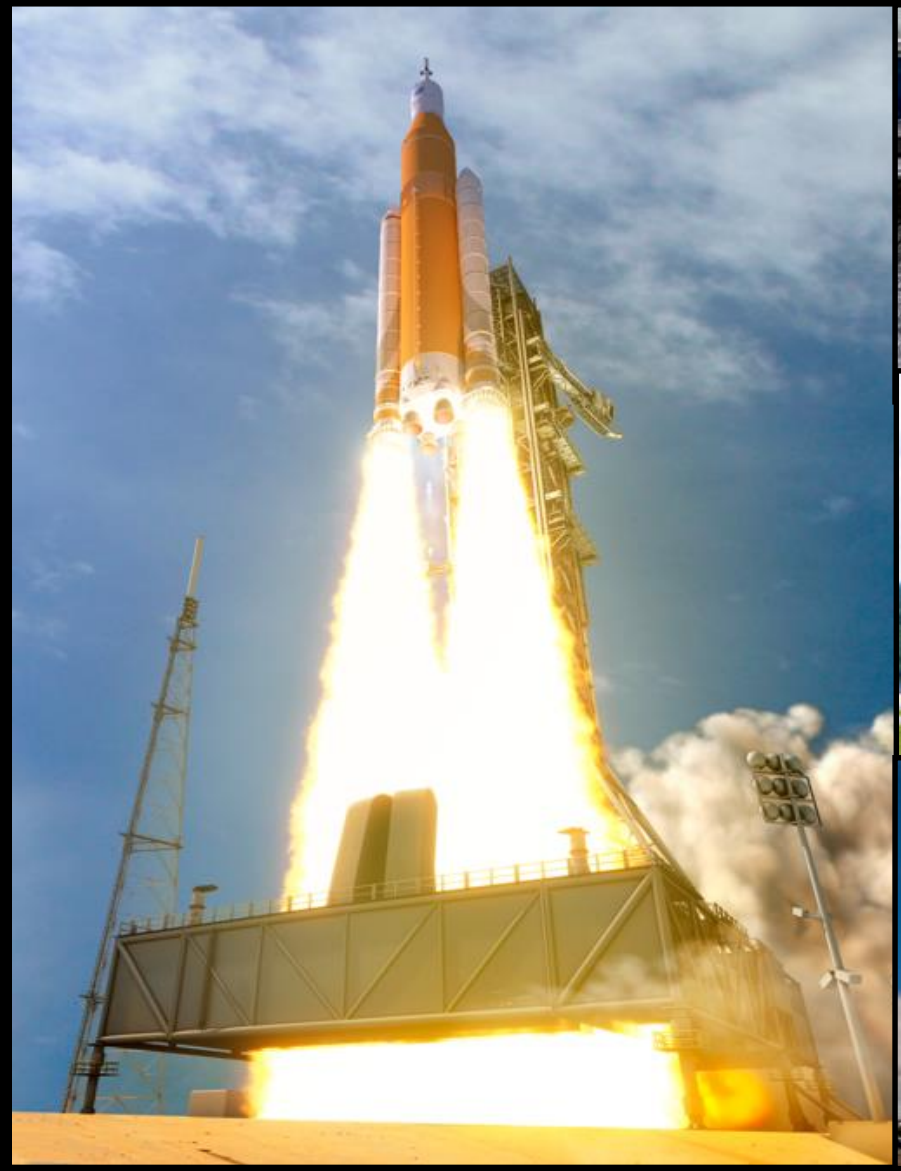
Today, some 90 nations are involved in research on ISS

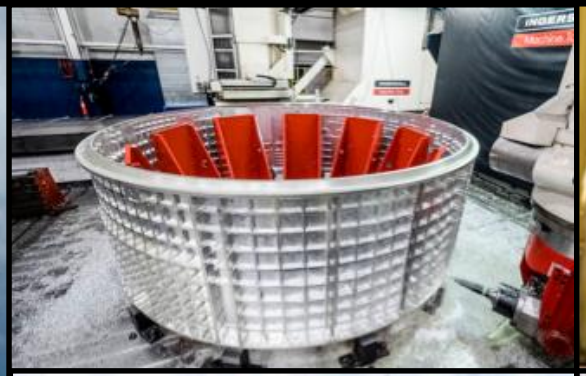
BUILDING BLOCKS TO DEEP SPACE

ORION – SPACE LAUNCH SYSTEM – EXPLORATION GROUND SYSTEMS

Launching from a modernized Kennedy spaceport, Exploration Mission-1 is the first integrated flight of the SLS rocket and Orion spacecraft demonstrating our commitment and capability to push farther into deep space – to the Moon, Mars, and beyond.

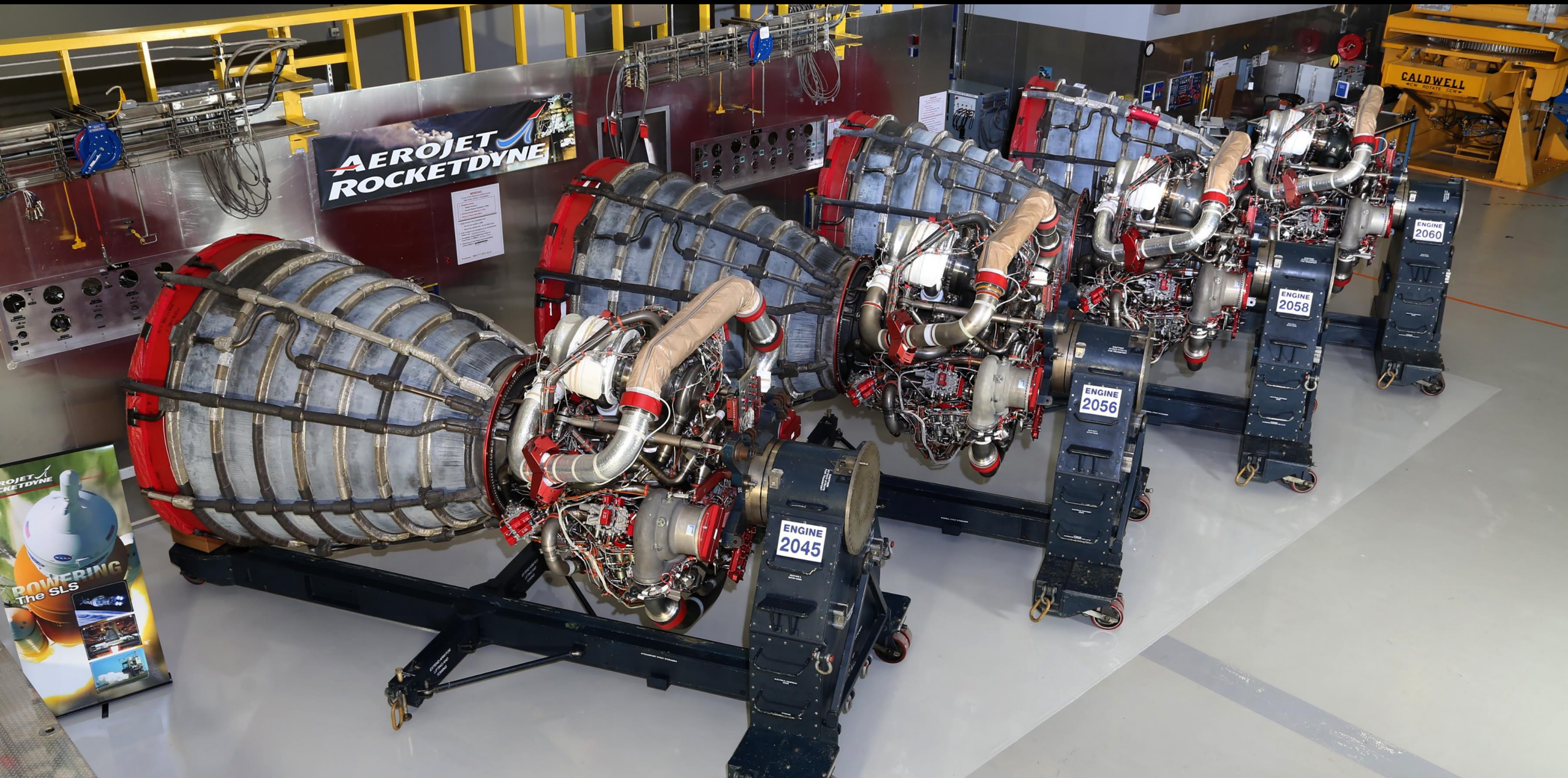
EXPLORATION SYSTEMS DEVELOPMENT





ORION SPACE LAUNCH SYSTEM GROUND SYSTEMS

RS-25: ENGINES FOR SLS'S FIRST FLIGHT



Germany
- Prime Contractor
- European Service Module Assembly Integration & Verification
- Propulsion and Propulsion Drive Electronics
- Centralised Parts Procurement Agent
- On Board Data Network Harness for Qualification Module

Italy
- Structure
- Thermal Control System
- Consumable Storage System
- Power Control and Distribution Unit
- Photovoltaic Assembly
- Meteoroid and Debris Protection System

France
- System Tasks
- Avionics qualification
- Direct Current Harness
- Front End Electronics
- Helium Filters

Switzerland
- Secondary Structure
- Solar Array Drive Assembly
- Solar Array Simulator
- Mechanical Ground Support Equipment

Belgium
- Tank Bulkhead
- Electrical Ground Support Equipment
- Pressure Regulation Units

USA
- Gas Tank
- Valves
- On Board Data Network Harness for Flight Module

Sweden
- Propulsion Qualification Module Integration

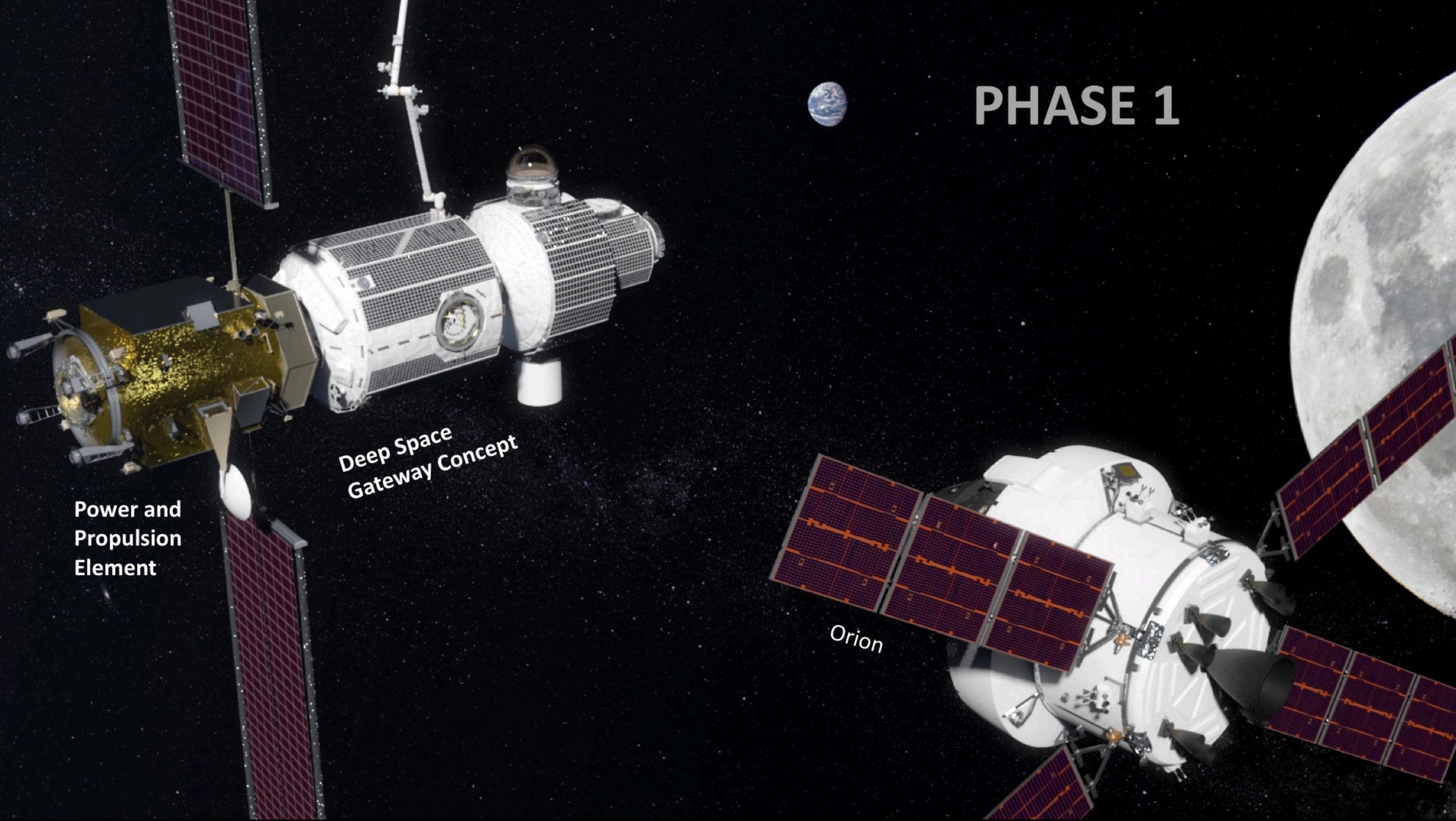
Denmark
- Front End Electronics
- Electrical Ground Support Equipment

Norway
- Hydrophobic Filter

Spain
- Thermal Control Unit

The Netherlands
- Solar Array Wings

FIRST NATIONAL SPACE COUNCIL


PHASE 1
Deep Space
Gateway Concept
Power and
Propulsion
Element
Orion


NASA